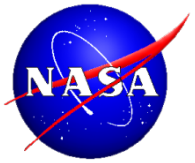

Global Precipitation Measurement (GPM) mission

Precipitation Processing System

PMM Science Team Meeting-2017

GPM Data Products and PPS Status

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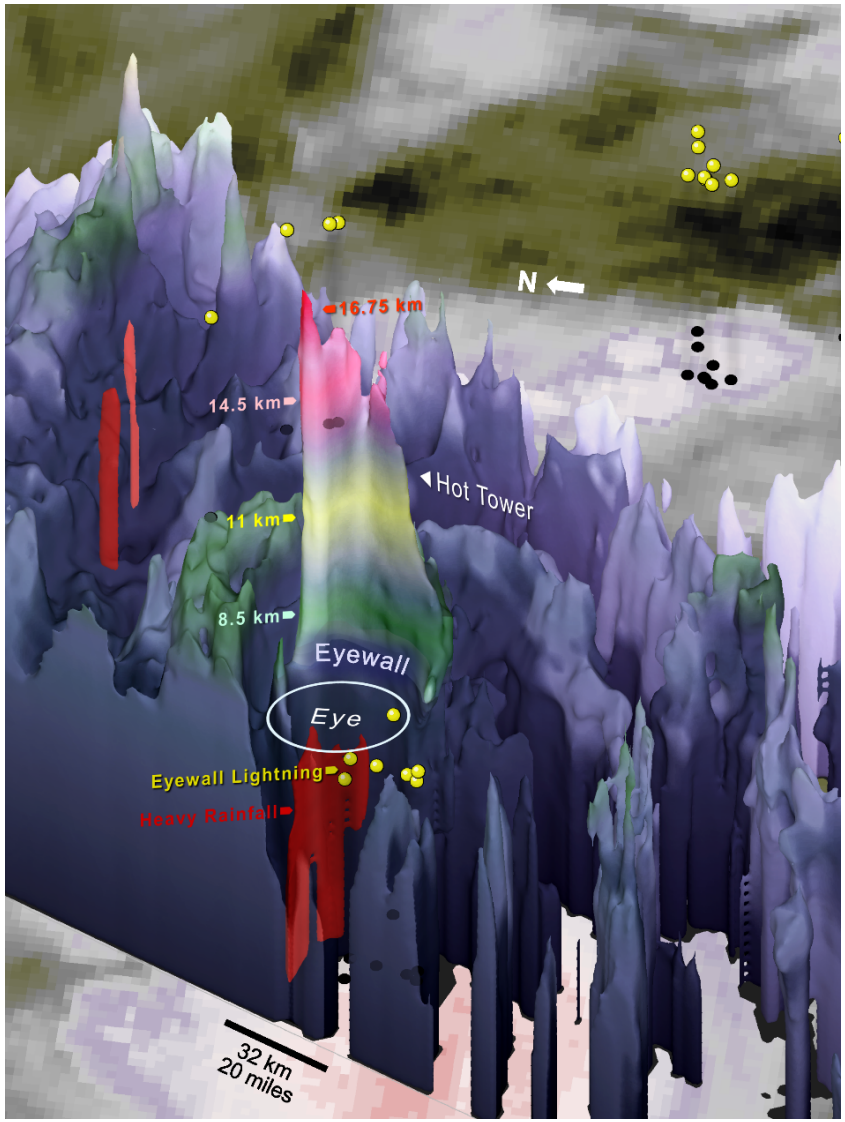
Maria As Seen By GPM Ku



Getting GPM Data Products

- **For research products you should be registered either with**
  - registration.pps.eosdis.nasa.gov
  - Or the EOSDIS GSFC DAAC
- **For NRT products you should be registered with**
  - registration.pps.eosdis.nasa.gov
  - During registration you should check box that you are interested in NRT
- **Registrations are necessary for IT security and system/product usage reporting**
- **Periodically messages are sent via email registered and if a message bounces the user will be removed from GPM data access**
- **No restrictions on either research or NRT data access**
- **If a user uses software such as BeBox that requires manual intervention for an email to get through, that user will be removed**

Data Status Overview

- **PPS research production system and NRT core satellite and partner constellation products are at data product version V05**
  - V05 started May 3, 2017
  - L1 – L3 V05 in production subsystem
  - L1-L2 V05 in NRT subsystem
- **IMERG final (research products) are at V04 and stopped with the start of V05.**
  - Last IMERG V04 for February 2017 as need to wait appx 3 months for required ancillary data
  - IMERG V05 is currently in testing
  - Possible start in November of IMERG V05
- **IMERG NRT (both early and late back to March 2014) are being produced as V04**
  - A special version of IMERG in NRT that gets V05 GPROF input products and generates a V04 IMERG
  - Current plans ca

TRMM Version 8 Reprocessing Status

- **With TRMM version 8 reprocessing TRMM data becomes part of the GPM V05 data suite**
  - Stored in HDF5 with internal compression
  - GPM file naming convention is followed and products like 2A12, etc disappear
  - Algorithms used for processing are direct or slightly modified V05 algorithms
  - Only the 2A-clim of GPROF algorithm produced because no GANAL for period whereas ERA-Interim available for the entire period.
- **Currently have completed level 1 processing for TRMM version 8/V05**
  - GMI L1 base, L1B, and L1C are complete
  - PR L1B is complete
  - All partner constellation L1C are complete
    - Intercalibrated to TMI that was calibrated by GMI using the overlap period
    - AMSRE, SSMI, SSMIS, AMSUB, MHS and ATMS before GPM complete
- **During the week of PMM meeting will start some TRMM version 8 processing of partner GPROF L2/L3 (where GPROF has been approved as part of GPM V05 activities**
  - SSMIS, AMSR2, MHS, ATMS
  - Can not process before 2006 as some required ancillary data not yet available
  - Again GPM file naming conventions are used.

Remaining TRMM Version 8 Reprocessing

- **Current draft schedule and plans call for remaining TRMM L2/L3 products to begin in early 2018**
  - L2/L3 PR
  - L2/L3 Combined
  - TMI, AMSRE, SSMI, AMSUB GPROF L2/L3
  - Latent Heating
- **IMERG reprocessing back to 1998 will begin in Spring 2018 if**
  - IR products required can be obtained from NOAA
  - After IMERG team have the opportunity to study all the GPROF and combined
- **GPM project science team, PPS, and GV will need to analyze and combine the remaining TRMM version 8 products**
- **JPST will need to receive the analysis and recommendations and then approve the release of the additional TRMM version 8 satellite products.**

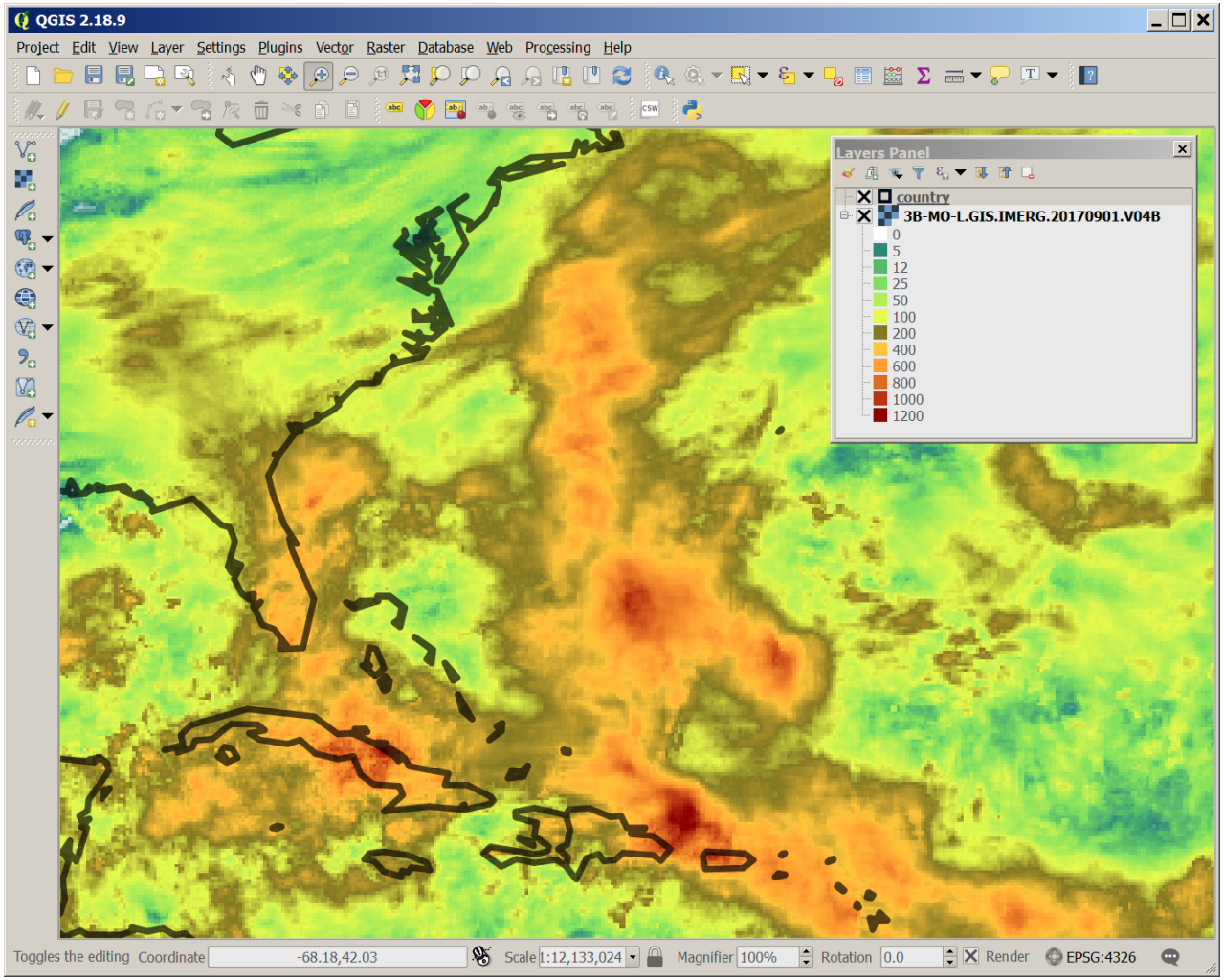
Gridded ASCII Text Products

- **Gridded text products**
  - .25° x .25° hourly grid
  - Packaged as daily files
  - Monthly rollup also available
  - Parameters on line space separated
  - Lines are NL terminated
  - 5 header line
  - Each data line starts with row, col, hour, earliest min followed by appropriate sensor group
  - Each sensor group has: total pixels, precip pixels, precip rate, convective rate, frozen rate and worse case grid data quality
- **Core satellite sensor group**
  - GMI GPROF
  - KU
  - DPR
  - Combine
- **Imager**
  - GMI, AMSR2
  - F16, F17, F18, F19 (when available)
- **Sounders**
  - MetopA, MetopB, NOAA18, NOAA19
  - NPP ATMS

IMERG GIS-Friendly Format

- **At application user request created version of IMERG half-hourly product in TIFF/TFW (specifically asked NOT to put them in geoTIFF)**
  - These are also at V04
  - Available back to March 2014
  - Available both on research production (final) and NRT (early and late)
- **Precipitation accumulations also provided in TIFF/TFW format**
  - 3 hourly, 1 day and 7 day. Each half-hour these are added so they are rolling.
  - Monthly (recently added to the NRT at user request). This a physical month.
  - Total accumulation, convective accumulation, and frozen accumulation available for each month from March 2014 to the present
  - Starting on the 5th day of each month, a month-to-date accumulation is updated each day of the month.
- **When final IMERG data is reprocessed in production all the TIFF/TFW products are also reprocessed.**
- **Near-realtime has no concept of reprocessing as old data is not near-realtime**
  - However for user convenience to have a mission long consistent early and late, PPS does do retrospective processing of early and late NRT but they are not exactly the same as an actual NRT product
  - Done because some users never retrieve the best IMERG final product but stay with the NRT interim
  - Final products are directly gauge adjusted but NRT are not

TIFF/TFW Monthly in GIS



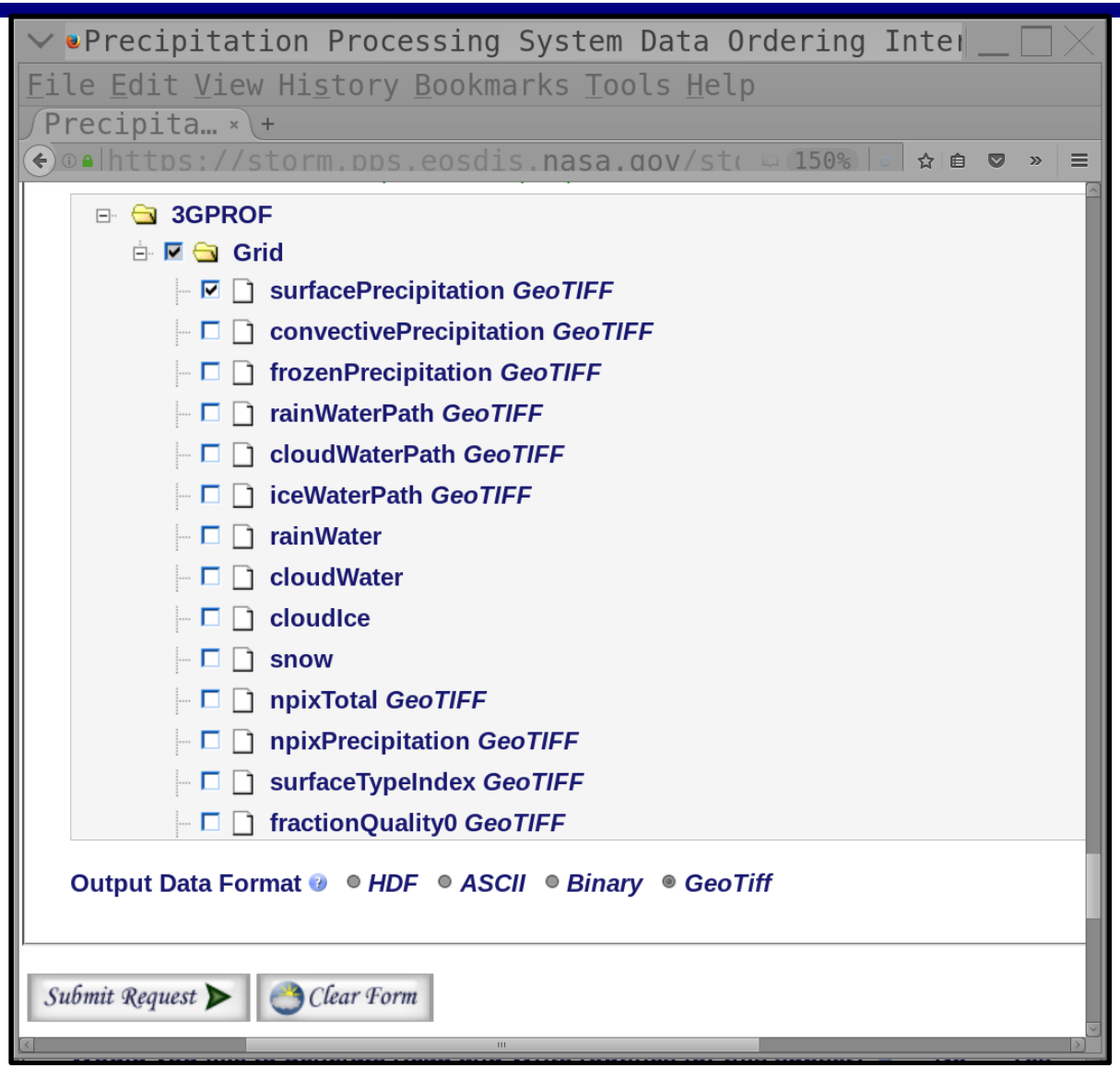
New Formats for Ordering

- **Have added BUFR formatted distribution**
  - See poster #216 by Yi Song entitled: BUFR and GRIB2 Reformatting System Development at PPS
  - Currently can order all 1C swath products in BUFR format
  - By beginning of December all GPROF products will be orderable in BUFR Format
  - BUFR tables were approved at WMO meeting
- **Have added GRIB2 formatted distribution**
  - See poster listed above
  - All GPROF level 3 products can be ordered in GRIB2 format
  - IMERG final product can be ordered in GRIB2 format
  - GRIB2 tables approved by WMO
- **PPS does make BUFR and GRIB2 approved tables available to user order data in those format.**

Level 3 Products in geoTIFF

- Based on several user requests
- This year, PPS added the GeoTIFF format to the list of output formats that users can request when making custom parameter subsets of GPM standard products using the STORM data ordering system
- Only gridded products in the HDF5 format can be subset into GeoTIFF files. Within these files, only 2 dimensional variables whose dimensions are Latitude and Longitude may be included.
- The list of the data produce for which GeoTIFF can be generated is GPROF daily and monthly files, Final IMERG 30-minute and monthly files, and the 3GCSH and 3HCSH latent-heating files

STORM Example of geoTIFF

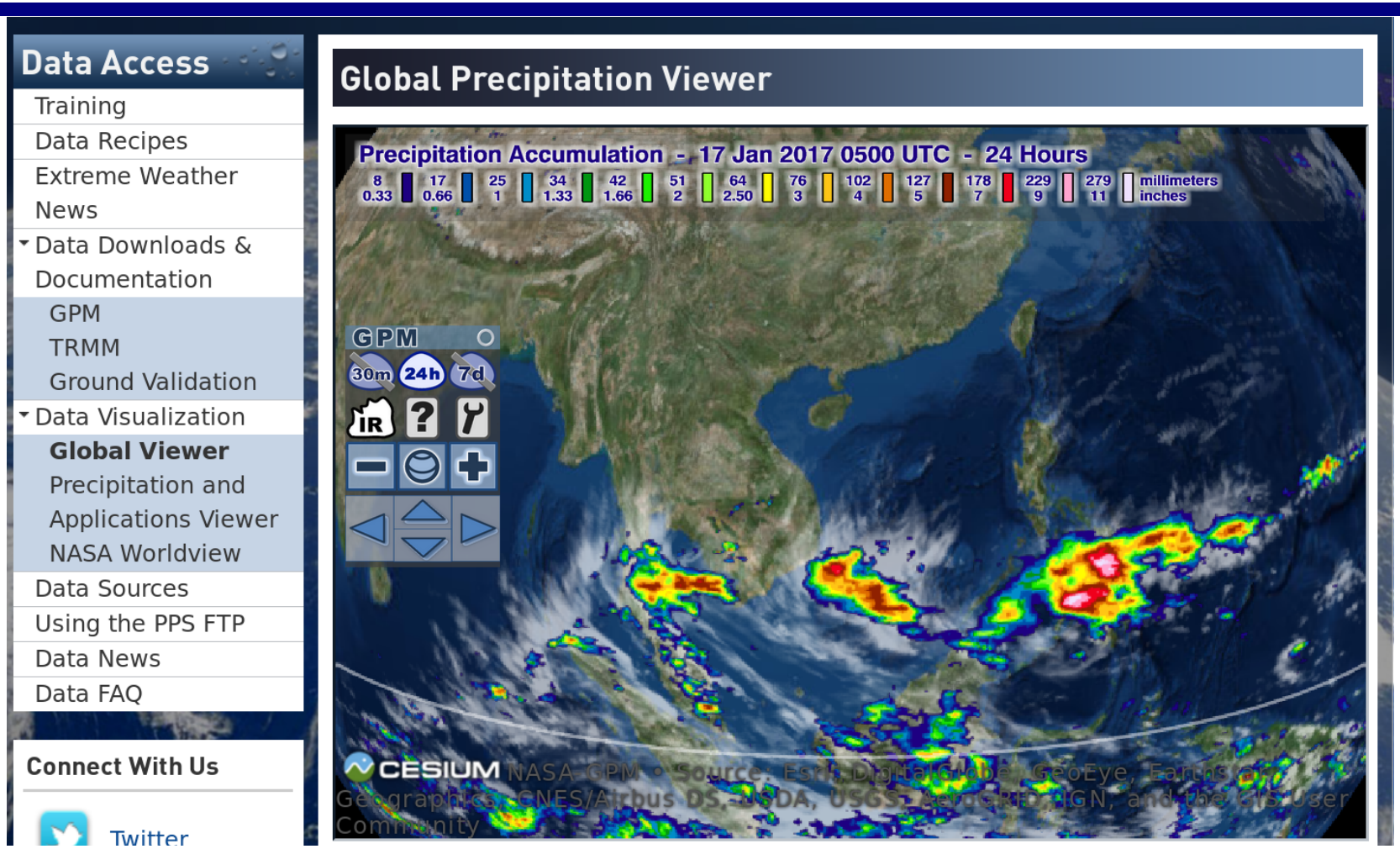


Routine Special Products Produced in Conjunction with PMM Partners

- **PPS continues to produce the University Utah/TAMU-CC Precipitation Features data sets.**
  - These are directly supported by the UU and TAMU-CC with very nice webpage
  - The individual products can be downloaded from PPS but detailed information only comes from the product partners
  - http://atmos.tamucc.edu/trmm/
- **PPS working with University of Washington produces Ku based geographically subsetted and analyzed radar products**
  - These are currently being produced for V05 for
    - North American subset
    - South America and Asia subsets
    - Central Indian Ocean subsets
  - Products will soon be supported by the University of Washington via a website
  - Similar TRMM products at http://trmm.atmos.washington.edu/

PRODUCT VISUALIZATION AT PPS

Viewing IMERG TIFF Accumulations



Available via pmm.gsfc.nasa.gov

IMERG for Virtual Globes (Cesium vs. KML)

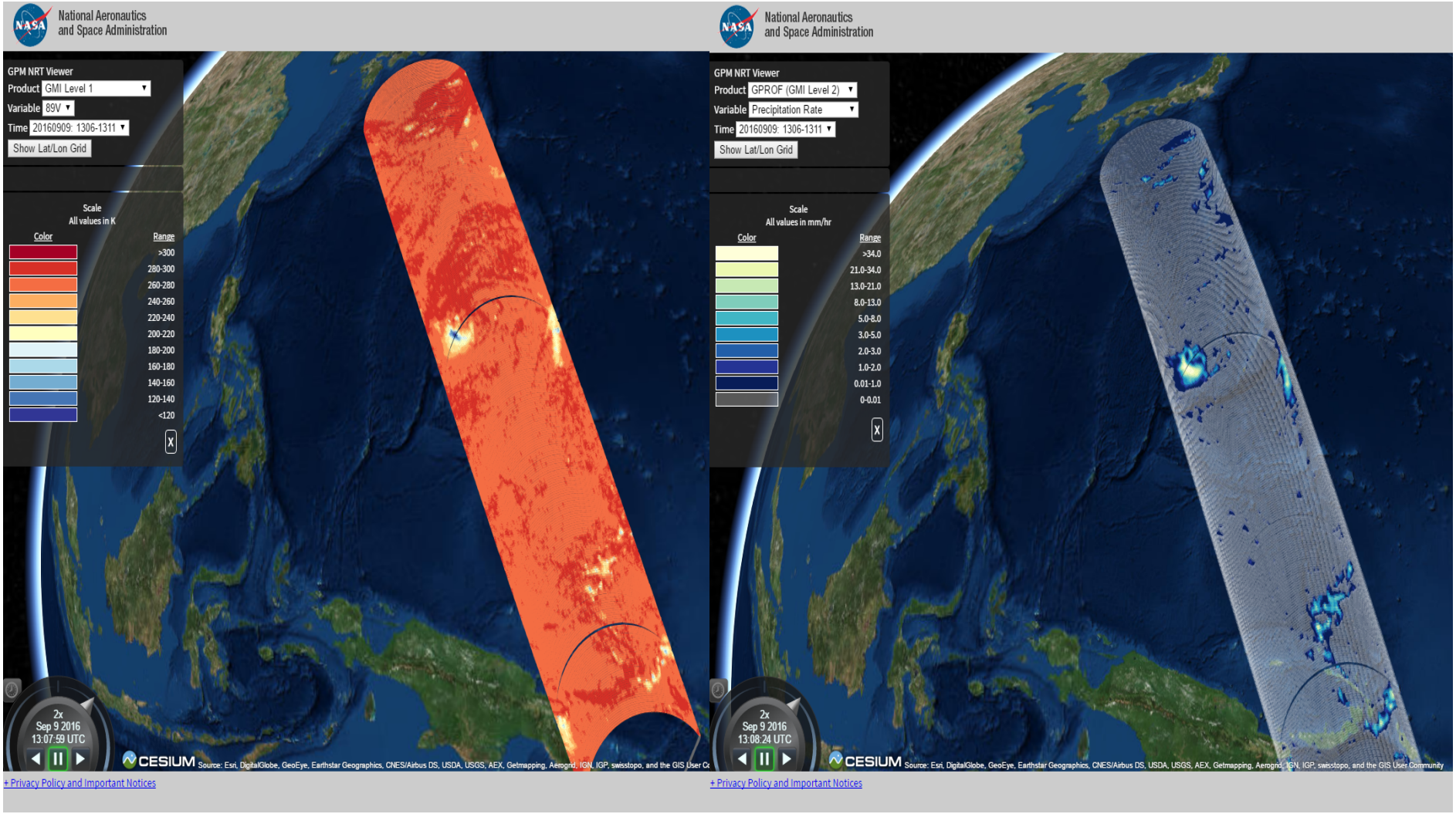
- Users can view the most recent 30-minutes, 24-hours, and 7-days of Late IMERG accumulation using the Cesium in-browser virtual globe on the PMM website.

- The URL is https://pmm.nasa.gov/data-access/global-viewer, and the application is called the "Global Precipitation Viewer."

- This Cesium instance replaces the Google Earth plug-in that was used prior to Google dropping support for this plug-in in 2016.

- Users may download (but not view online) the most recent 30 minutes, 24 hours, and 7 days of Late IMERG accumulation in the KML format (formerly displayed online using Google Earth).

NRT Viewer


National Aeronautics and Space Administration
GPM NRT Viewer
Product GMI Level 1
Variable 89V
Time 20160909: 1306-1311
Show Lat/Lon Grid
Scale
All values in K
Color
Range
>300
280-300
260-280
240-260
220-240
200-220
180-200
160-180
140-160
120-140
<120
2x
Sep 9 2016
13:07:59 UTC
CESIUM
+ Privacy Policy and Important Notices
National Aeronautics and Space Administration
GPM NRT Viewer
Product GPROF (GMI Level 2)
Variable Precipitation Rate
Time 20160909: 1306-1311
Show Lat/Lon Grid
Scale
All values in mm/hr
Color
Range
>34.0
21.0-34.0
13.0-21.0
8.0-13.0
5.0-8.0
3.0-5.0
2.0-3.0
1.0-2.0
0.01-1.0
0-0.01
2x
Sep 9 2016
13:08:24 UTC
CESIUM
+ Privacy Policy and Important Notices

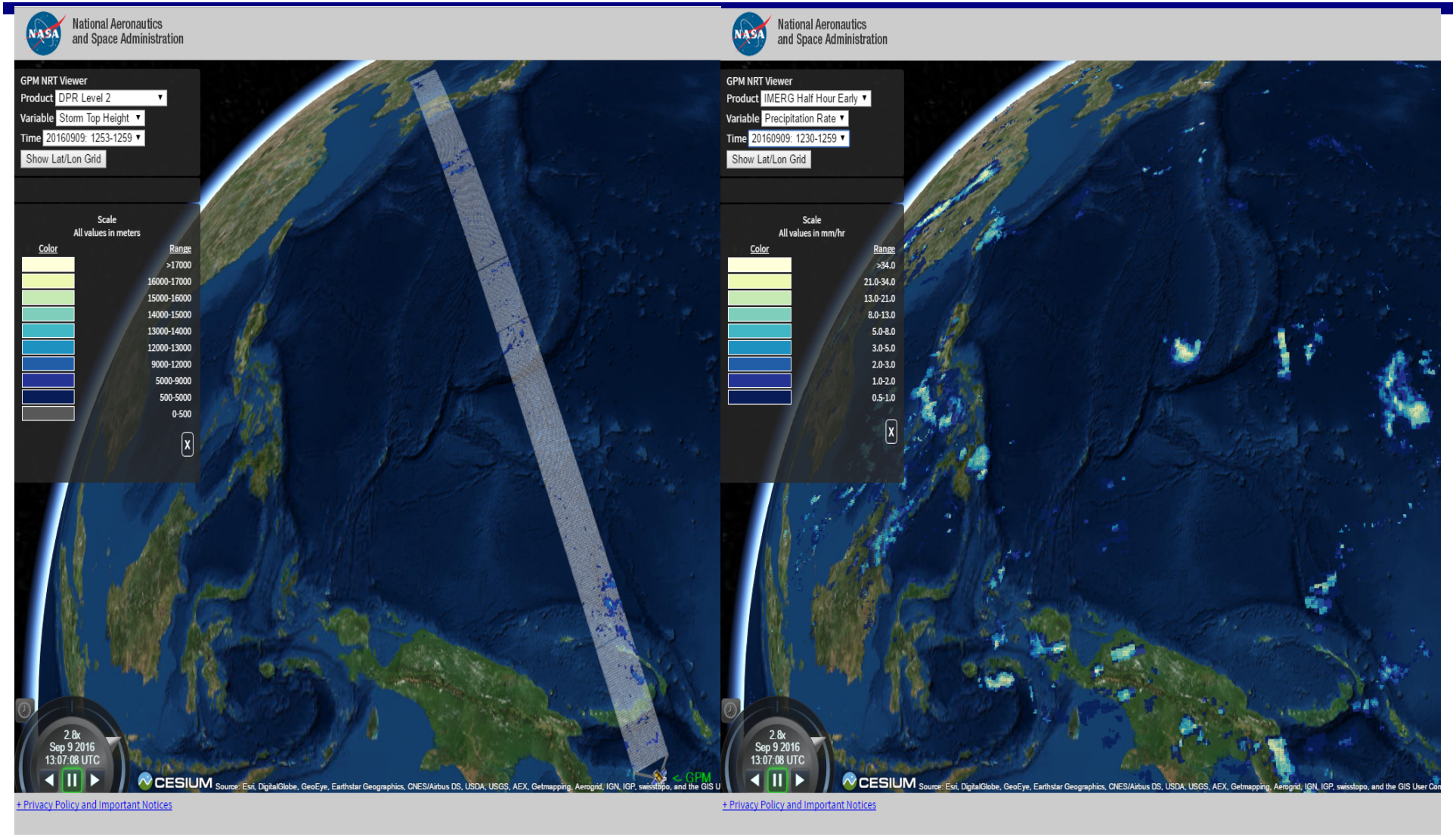
NRT Viewer

- As part of the Precipitation Processing System STORM data access portal, the Global Precipitation Mission (GPM) Near Real Time (NRT) Viewer helps users make better decisions about acquiring NRT data from the GPM Core satellite and Integrated Multi-Satellite Retrievals for GPM (IMERG) gridded product.

- It also provides a quick visualization of brightness temperature, precipitation rate, and storm structure information as soon as the data are available.

- Here we have a comparison of the Level 1C GPM Microwave Imager (GMI) and Level 2A Goddard Profiling Algorithm (GPROF) information available in GPM NRT Viewer. Note the relationship between the cool brightness temperatures in the 89GHz Vertical channel (left) and intense precipitation rates (right) in the system over the Central Pacific.

NRT Viewer-2


National Aeronautics and Space Administration
GPM NRT Viewer
Product DPR Level 2
Variable Storm Top Height
Time 20160909: 1253-1259
Show Lat/Lon Grid
Scale
All values in meters
Color
Range
>17000
16000-17000
15000-16000
14000-15000
13000-14000
12000-13000
9000-12000
5000-9000
500-5000
0-500
2.8x
Sep 9 2016
13:07:08 UTC
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS U
GPM
+ Privacy Policy and Important Notices
National Aeronautics and Space Administration
GPM NRT Viewer
Product IMERG Half Hour Early
Variable Precipitation Rate
Time 20160909: 1230-1259
Show Lat/Lon Grid
Scale
All values in mm/hr
Color
Range
>34.0
21.0-34.0
13.0-21.0
8.0-13.0
5.0-8.0
3.0-5.0
2.0-3.0
1.0-2.0
0.5-1.0
2.8x
Sep 9 2016
13:07:08 UTC
CESIUM
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Com
+ Privacy Policy and Important Notices

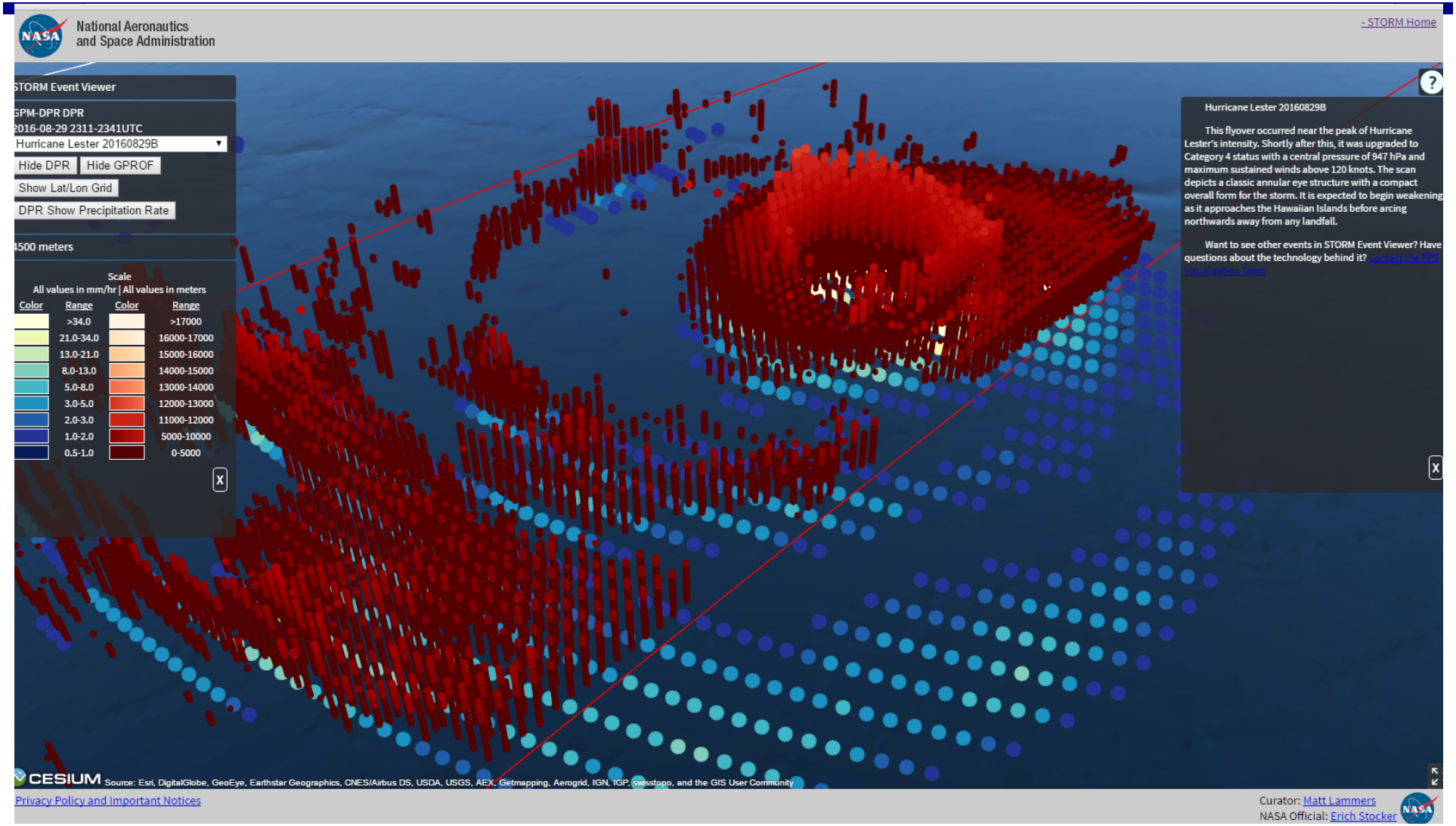
NRT Viewer-2

- Also featured in the GPM NRT Viewer are the GPM Dual-frequency Precipitation Radar (DPR) and the 30-minute "Early" IMERG. These are shown here from the same time frame.

- While the narrower DPR swath misses the intense storms shown in the GMI and GPROF, it does capture some towering convection near Papua New Guinea. Along with precipitation rate information, this interface can show DPR Storm Top Height (shown here) and Precipitation Type. Brighter colors represent taller storms.

- The 30-minute IMERG shows precipitation rate information derived from observations from GPM and all of the partners, mapped onto a 0.1x0.1 degree grid. The precipitation rate information from GPROF is apparent in the IMERG.

Event Viewer



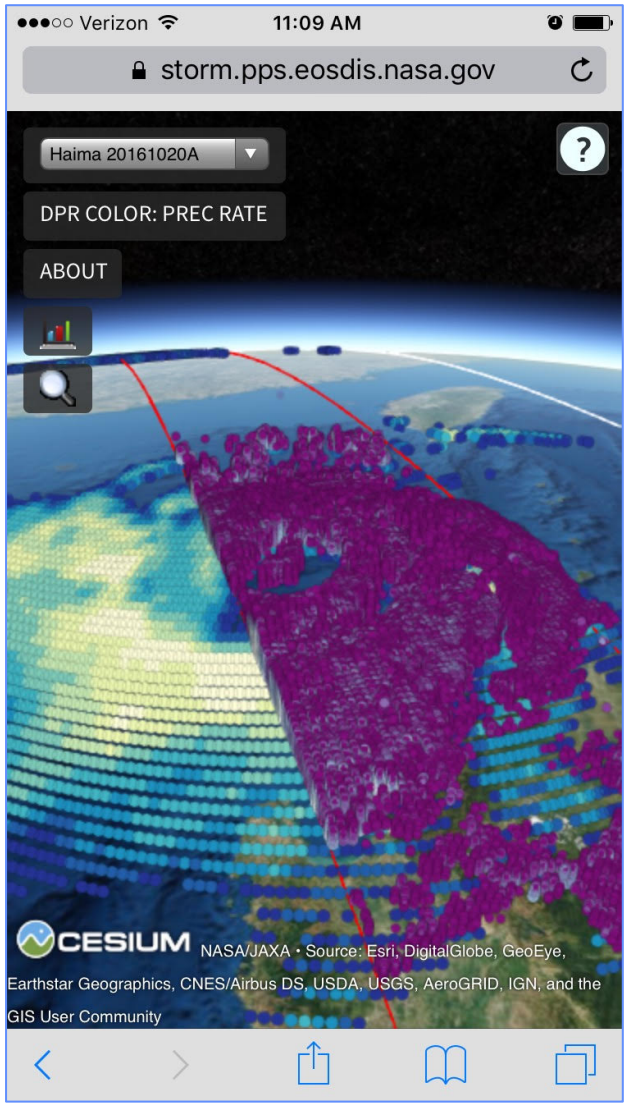
Event Viewer

- The STORM Event Viewer, currently in development, curates specific high-impact cases from NRT data and displays them in 3D, combining both the DPR and GPROF data to illustrate both the verticality and spatial extent of a tropical system.

- Here we have a flyover of Category 4 Hurricane Lester in the Eastern Pacific on 29 August 2016. Each of the data points are mouseover interactive, so the user can easily see that the tallest storms in the eye wall are 12.5 kilometers high, and the peak GPROF estimated rain rates exceed 50 millimeters per hour.

- STORM also features its Virtual Globe viewer, which is tied to the production data order interface to again help with decision making and which presents information in a similar fashion to the Event Viewer. All of these interfaces use Cesium.JS software for 3D globe visualization, which is open source and well-supported.

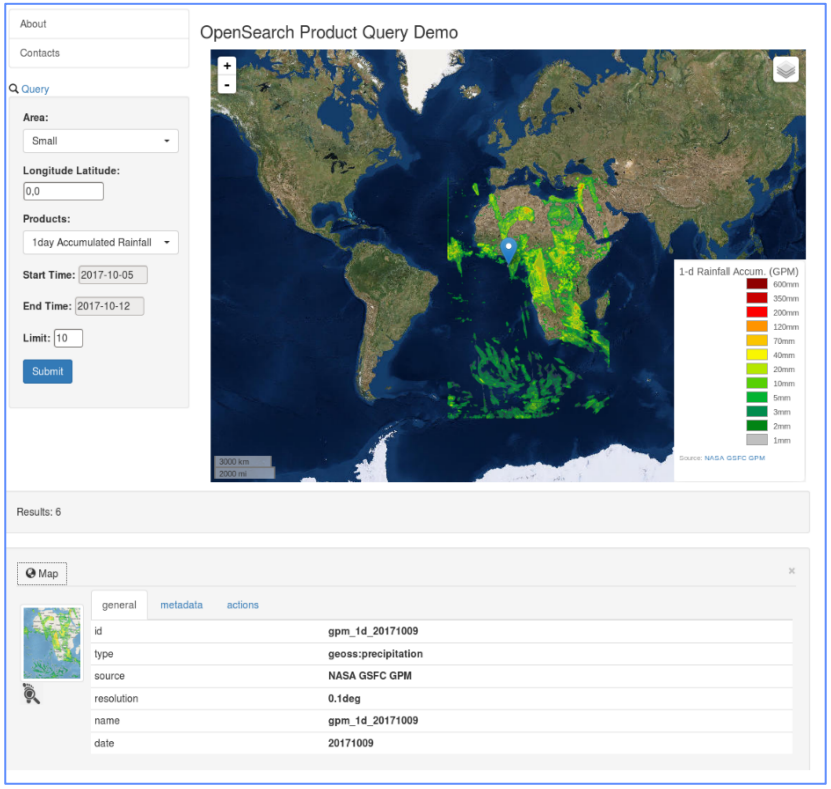
STORM Event Viewer Mobile (EV Mini)



https://storm.pps.eosdis.nasa.gov/storm/cesium/EVMini.html

Explore the GPM overflights in the STORM Event Viewer interface on mobile devices and tablets using EV Mini.

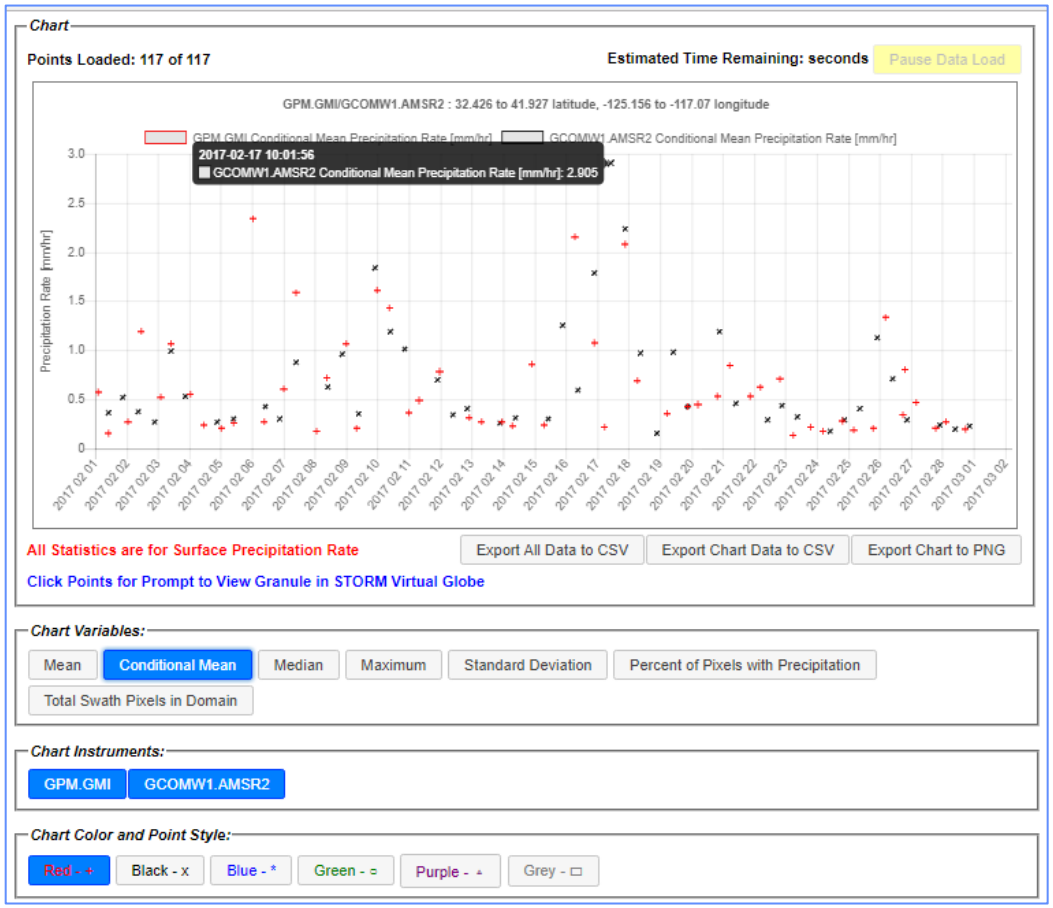
PPS Role in PMM Publisher



https://pmmpublisher.pps.eosdis.nasa.gov

PPS runs the data processing for the PMM Publisher, converting the IMERG raster files into vector formats such as geoJSON and shapefile. PPS also hosts the PMM Publisher API.

Analysis of Data Online—Dec 2017



Coming soon – a tool to explore statistics from geographically subset segments of Level 2 swath data. Compare instruments, find coincidence and high-impact events, link quickly to other visualization tools.